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ABSTRACT

The papers in this collection of presentations at a conference of the University/Urban Schools National Task Force address topics on trends in educational technology and issues in teaching with educational technology. The following papers are included: (1) "The Appropriate Use of Technology in Education" (James E. Dezell, Jr.); (2) AT&T and the Future of Educational Technology" (James P. Burke); (3) "The School of the Future" (Judith Johns Hubner); (4) "The Past as Invitation: The Video Encyclopedia of the 20th Century" (Roger B. Fransecky); (5) "Information Retrieval and the Computer" (Ronald J. Boehm); (6) "Technology and the Student's Education" (John Vasconcellos); (7) "American Federation of Teachers' Perspective" (David H. Florio); (8) "National School Boards' Perspective" (James A. Mecklenburger); (9) "A Professor's Perspective" (Alfred Bork); (10) "A Publisher's Perspective" (Richard Robinson); and (11) "Educational Technology in California" (Bill Honig). A concluding statement by Fred Hechinger and a list of conference participants are also provided. (MES)

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PROCEEDINGS:

The Eighth Conference of the
University / Urban Schools National Task Force

New Frontiers in Educational Technology: Trends & Issues

Edited by Richard M. Bossone
and Irwin H. Polishook

The Graduate School and University Center
of The City University of New York

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1987

PREFACE

The realities of change and progress have long been characteristic of American history. As a supremely confident people, we have always assumed each challenge of an age could be surmounted by advances in technology and their extensive applications in society. One may wonder to what extent this traditional American bravura has been diminished by complex domestic and foreign problems that confront the nation in this last segment of time left in the twentieth century. Signs of ambivalence are prevalent whenever public opinion is tested regarding the inevitability of progress that depends on technology.

Consider the national experience with technology and education. During one period of the 1950's, there were advocates of so-called teaching machines whose inventions and projects were sponsored by those who became veritable salesmen of perfectibility in schools; these machines were certified as "teacher proof," thereby guaranteeing unending pedagogical success. Today we know better. Despite its occasional zealots, few educators expect technology by itself to improve or revolutionize our schools. We aim at realizable goals which maximize the utilization of technology without violating common sense standards about what is needed to promote reform and excellence.

In contrast to our erstwhile engagement with gadgetry, the present courtship of educational technology is vastly more promising. To begin with, the most popular machines include computers and VCR's which represent technology that is virtually coextensive with business and the home in

American society; familiarity is a major step on the way to effective development. We have also learned some of the most obvious lessons about the past misuse of educational technology. No combination of machine and program will succeed if teachers are not involved in their creation and classroom usage. Moreover, we now understand the importance of moving beyond the employment of technology for tasks that simply replace teachers or perform functions as pedagogical drillmasters; innovative educational technology means more than service in the routine functions of an automated tutor or electronic textbook. Above all, we know the best applications of educational technology should do more than fill gaps in the curriculum. The entire academic program must be rebuilt so that the widest range of courses and expectations become part of a renewed commitment to educational excellence.

Every participant in this conference on "New Frontiers in Educational Technology" recognized that the interactions of students, teachers, administrators, professors, and enlightened public officials are essential to the next generation of successful educational technology development. Indeed, the theme of "interaction" is the guiding principle of the University/Urban Schools National Task Force, a group of leading educators who have met annually over the past decade to consider topics of special relevance to the public schools. It is our hope that these proceedings will add in some measure to the continuing debate about educational technology and the improvement of instruction in America's schools.

R.M.B.
I.H.P.

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THE APPROPRIATE USE OF TECHNOLOGY IN EDUCATION

James E. Dezell, Jr.
Vice President and General Manager
IBM Educational Systems

The American educational system has an awesome task to perform. Educators must prepare our school children to become productive citizens who can function effectively in society at a time of increased school dropouts, demographic shifts that are rapidly changing the composition of the nation's classrooms, and growing shortages of qualified teachers. The U. S. Department of Education reported that in 1982 there were 2.5 million graduates from American high schools. There were also nearly one million more young people who should have graduated with them, but who dropped out instead. Last year the nationwide dropout rate was estimated to be 29% and in our great cities the problem is even more severe. The likelihood that a student entering an urban high school will actually finish with his or her classmates is getting smaller and smaller. In some cities, the dropout rate exceeds the rate of graduation and among minority groups literally half of those who start school drop out.

We also know that of the approximately two and one-half million adults under correctional supervision--in jail, prison, on probation, or on parole--at least two thirds did not graduate from high school. Present data suggest that nearly 60 percent of today's adult prison population cannot read or write well enough to function in society, and for juveniles who come before the courts, the number is closer to 85 percent.

The bottom line for business, society, and the individual is that now, more than ever before, an alarming percentage of the children entering our

schools may not graduate and lead productive lives. Our young people are almost unrecognizable in contrast to their counterparts of only twenty years ago. There are more from poverty households, more from minority backgrounds, more whose home language is not English, and more whose parents are also children.

Yet, as the number of difficult-to-educate children is increasing, the overall student population is decreasing. In 1978, young adults constituted 23 percent of the United States population; by 1995, young adults will constitute only 16 percent. It is within this shrinking potential labor pool that the growing presence of unskilled, undereducated young men and women may have the most severe impact.

These undereducated young people join, and amplify, more than one-fifth of America's adult population who are functionally illiterate. In fact, current estimates suggest that America's illiterates are growing at the rate of 2.3 million persons each year. This number includes the nearly 1 million young people who drop out of school, 13 percent of all 18 year-olds, and 44 percent of our Black youth.

At the same time these changing demographics are severely straining our nation's schools; changes in the fundamental structure of the United States economy have all but eliminated the need for many unskilled jobs. Because our economy is becoming more heavily based on services and high technology industries and less on traditional manufacturing, a substantial portion of today's workers and new employees are facing joblessness. They possess outmoded skills or lack the education necessary to make the transition to new work.

Between 1979 and 1982, the United States economy generated over 15

million new white-collar jobs and fewer than 2 million new blue-collar jobs. Today, service-and-information-based firms employ over 70 percent of American workers and create 90 percent of the new jobs. While our society makes this transition, where will untrained, uneducated people go to make an honest living? And further, who will be there to educate, train, or re-train them?

Equally distressing is the growing gap between teacher supply and demand. Last May, the Carnegie Forum on Education and the Economy reported that between now and 1992, 1.3 million new teachers will need to be hired. Although the number of teachers retiring or leaving the system will rise sharply, there will be many fewer teachers in the pipeline. There will be fewer graduates in education, both at the bachelor and masters level. Of the qualified graduates, fewer are choosing teaching as a profession. Amongst math and science teachers already teaching, dramatically high numbers are leaving for industry each year.

In short, as the complexities of our technological, information-oriented society demand even greater skills, there is concern that the number of under-educated people will continue to grow. Left unabated, this increase can create a permanent underclass of uneducated, untrained, and economically dependent citizens. It is obvious that such a development will have profound economic, social, and political implications.

Reinvigorating our educational system is an enormous challenge to all of us and it will require initiative from virtually every part of society. In May, 1985, IBM created an independent business unit, IBM Educational Systems. IBM Educational System's principal goal is to find ways of using computer and other information technologies to help teachers teach and students learn.

For us, understanding the contribution that technology can make is an iterative process. Although I think we know more now than we did 18 months ago, we still have much to learn. We are gaining knowledge, however, from the many projects that we have in place with school districts across the nation, where technology is being used to address real educational problems and current needs.

For example, in the area of literacy and basic skills, we are making progress. We believe that teaching children to read and write is the single most important task of education. Without the ability to read and write, the child is cut off from the learning process. Although the data I quoted earlier suggest that children drop out in the tenth grade, they really drop out in the first or second grade, when they do not master reading and writing. A child who does not gain these abilities becomes disenfranchised from the learning process and later disenfranchised from society.

As many of you are aware, our first educational software product, Writing to Read, is designed to address this very difficult area at an early age, kindergarten and first grade. In the Writing to Read program, the computer creates a success oriented, risk-free environment where school children invent a new tool: the written word. Through their understanding of the logic of writing, they begin to communicate: first in words, then in sentences, and finally, in paragraphs and stories.

What is significant for us with Writing to Read is not only that it is effective and successful (over 300,000 school children this year went through Writing to Read), but perhaps just as important, it represents a model where technology is being used appropriately. This program is not a high-priced page turner; it is an interactive part of a learning system environment that

requires exploration and inquiry on the part of the student and guidance and direction on the part of the teacher. With Writing to Read, the computer is being used to create a new tool for the student: written communication. After the student learns to write and read, the computer can further empower the thought process through its unique ability to serve as a vehicle for the manipulation of words, concepts, and ideas.

In a closely related area, we are researching the use of technology to promote experience-based learning, where youngsters can develop insights into phenomena that cannot be directly seen or easily observed. For physics, chemistry, and even for social studies, simplified models of complex real systems can be compelling tools for learning.

We are also investigating the use of computers and advanced technology to leverage the very scarce resources of our expert teachers. In remote areas where there is no access to subjects that are taught by teachers in short supply, technology can make a difference. For example, last year we were contacted by the state of Utah and were asked to assist in developing a foreign language program that would use a master teacher, interactive educational television, satellite distribution of instruction, and microcomputers equipped with digitized voice capability and speech recognition. In September, 1985, we began program implementation in 24 schools in Utah, and later in Arkansas, Colorado, and Nevada. The early results are promising; they indicate that students are mastering two years of conversational Spanish in one year.

We believe that the implications are much broader than Spanish. Why not, for example, French, Latin, Greek, or even physics, chemistry, or calculus? The equity issue of availability of high quality courses to all

students, in all areas of the nation, is one that technology can help us to address.

There are many other broad categories, programs, and approaches where substantial progress is being made in understanding how to best use technology in education. As our understanding evolves, so is the affordability of educational technology, its capability, and its potential. Educators are learning how they can benefit from the use of hierarchical networks and integrated solutions. Teachers and students are finding how they can best "tap into" and use large databases. In special need areas, instructors of the physically impaired are discovering how technology and adaptive devices can be put to use for the benefit of the handicapped student and the disabled worker. Developers are even learning how the power of highly sophisticated systems, such as touch-sensitive interactive videodisc technology, can be redirected and used by adult illiterates to learn to read and write.

I hope these few examples will provide an insight to the approach IBM has taken concerning the central question of how new information technologies can be appropriately used to extend, and perhaps even transform, teaching and learning. IBM has only been involved in this process for a little over a year. We have learned much and we expect to learn even more in the months to come.

AT&T AND THE FUTURE OF EDUCATIONAL TECHNOLOGY

James P. Burke
General Manager
AT&T Educational Systems

Because we live in a period when important knowledge is doubling every five years and universities are said to be generating 50,000 pages of new research every minute, my focus today will be on the implication of the information explosion and what role AT&T can play in improving education.

The key to the use of technology is in its application to the movement and management of information. Technology can offer a solution to the information explosion in the education process if we focus clearly on three concepts:

- Classrooms and schools are both administrative and academic units.
- All constituencies responsible for the total support of a school system are critical to the process of identifying problems, planning solutions, and establishing trials.
- Proper funding of solutions is necessary in implementing any potential solutions and long-term success in integrating technology with education.

AT&T has made these concepts the cornerstones of its strategy toward the education market. These ideas will be discussed in more depth.

First, schools answer to many constituencies and require a complex system of support. Our school systems ask classroom teachers to provide information for the administration of the system and to inform its many constituencies: parents, the building principal, area superintendent, the school board, the state, the federal government, and the country. So, not only is information being produced "out there", but schools are also creating information, adding

to the information explosion.

Schools are more than ever both academic and administrative units. Traditionally, the computers used for administrative reporting were behemoths at an operations center, far from the classroom on which they depended for input. And because of the distance and lack of communication, the input was usually manual at the classroom and building level.

The advent of microcomputers was first seen as a boon to the academics in the classroom. Vendors dropped off roomfuls, and kids became "computer literate" (usually far in advance of their teachers or parents). But if teachers used the PC's for administrative tasks, the output was not able to be fed to the mainframes. This technology offered no relief to teachers or administrators from manual generation of information.

The dollars spent for computers by elementary/secondary schools will continue to rise. T.H.E. Journal projects school systems will be spending some $7 million per year by 1990, an increase of nearly $2 billion over 1985. It is our contention that the best use of computer dollars allows the same equipment to perform both administrative and academic functions. Combining super-microcomputers like our 3B line of processors in a network with other PC's and mainframes has positive results for administration and academics. Administrative work by the teacher in this system can be provided to the school's center of information, from which reports can be generated for the district and others.

Computers used in a distributed, networked system become more academically supportive than a PC alone could ever be. Systems help manage the information explosion for the classroom teacher by giving access to the outside world: public-access databases, public domain software, and

courseware made available through various networks. Technology applied to education is much more than personal computers running spread sheets or word processing software. This represents an integrated technology with computers as tools that network students, teachers, administrators, and school districts to other offices. It also represents an updated courseware delivered to the student desk top, controlled by the teacher, aligned with district/state learning objectives and testing. This kind of education, both academic and administrative, is not possible with PC's alone.

Basic skills delivered via technology offer modular instruction. And once information can be packaged, learning can be self-paced. Individualized, self-paced instruction allows for the mainstreaming of the academically disadvantaged while offering enrichment possibilities for the advanced. In addition, computers designed to run via voice response will prove to be a boon in instructing many of the physically handicapped. It is well known that students with the advantages of technology in the teaching process continue to excel in common measures like test scores.

We have heard, and understood, all the concerns put forth by people like Theodore Roszak in his book The Cult of Information. Roszak says that true thinking is not the mere collection and processing of bits of information. We could not agree more. But reports and forms are made of bits of information. To off-load the collection and sorting of those bits of information, to off-load both the routine of instruction and administration from the teacher are what computers do best. Moving the routine to a teacher-managed, teacher-controlled machine frees the teacher for more productive teaching, and that is the value of technology in education.

The second part of this discussion concerns the role vendors will play

in the application of technology to the process. We vendors have made some mistakes in the past. The memory of backing up a truck to deliver a roomful of unsupported PC's should strike fear in the hearts of more than one vendor.

I believe those times are gone. The experimental stage is over. Early experiments with PC's have proved their real benefit. One of the most important outcomes has been the awareness of all constituencies and their role in the process.

AT&T believes that the many constituencies responsible for the support of a school system are critical in identifying problems, planning solutions, and establishing trials. The education community understands its own problems, such as excessive dropout rates, state mandated proficiency testing, and sex education requirements; and it can assess the solutions better than any vendor. Without constituency involvement in the process of identifying solutions and establishing trials, the future of vendor involvement will be fraught with difficulties.

Let me highlight a few of our experiments to emphasize the constituency involvement we believe is so important. One test site is the Brookhaven Middle School, Placentia, California, where a classroom of the future combines many technologies--those of computers, satellite transmissions, radio and television broadcasts, large screen video projection, videodisc and local area networking. Because of its emphasis on networking, the test site allows access to a wide range of education software, databases, and services. It manages the information explosion, providing individualized, self-paced instructional materials--the development of which involves teachers, publishers, and software companies. The objectives of the course material are aligned with district and state needs, involving administration and

state policymakers. The Brookhaven School trial is the answer to "a roomful of unsupported PC's" in both concept and support.

A short time ago, AT&T announced an alliance with Indiana University to establish a different kind of model. The Indiana University Center for Excellence in Education will be a model instructional center, a teaching and research facility for the school of education, and a demonstration center for the latest advances in educational technology and applications. It will include research and development in traditional educational practices, adult literacy training, education at home, and corporate training. This joint effort between Indiana University and AT&T includes federal funding for construction, Indiana State appropriations, and generous gifts from private foundations and individuals. Local school districts will have shared access to curriculum and teaching programs developed there. Overall, the application of technology in an environment involving multiple constituencies will lead to what will become a model of vendor involvement. The Indiana project is not only an example of involving multiple constituencies in the process but also of being aware of how funding sources are crucial to implementing potential solutions via technology.

I wish to cite an experiment in Hillsborough, Florida. This experiment makes use of Chapter I federal funding available for the educational need of those defined as "educationally deprived." This experiment establishes a different kind of classroom of the future in which "at risk" students are offered technology as a vehicle to improve learning. Here Chapter I federal

funding was seen as critical to the support of the project, and the experiment was established with that in mind.

The issue of funding is more than just finding the money to carry out the plan set forth by the vendor. Control of the funding means control of the project. There can be no substitute for buying power. Let me explain by drawing a comparison to the evolution of our industry. In the early days of mainframes, a cult or mystique grew up around the computer. No one understood it except the high priests of "computerese." So to get information from the computer, to get anything done by the computer, we had to petition the keepers of the keys to the computer room. And because most of them spoke "computerese," we did not understand them.

With the advent of microelectronics, the cost of computers in comparison to power dropped dramatically; and as chip storage technology allowed for more sophisticated software, users started buying their own computers. We used to go to the data processing manager to ask how long before he could provide the program we needed on the mainframe. Now, we do not even ask, much less wait for an answer. PC's not only brought processing power out of the computer room; they brought control, control over how computers are configured, programmed, and used. There is no substitute for purchasing power.

Let me conclude by comparing the evolution of technology in education to that of the introduction of the automobile. When the automobile was first introduced, enthusiasts were viewed by many as fanatics. There were no roads built, no gasoline pumps available, no repair shops operating. So, when an early driver broke down, ran out of gas, or had a flat tire, he was greeted with "Get a horse!" Certainly the general public did not see the value of buying an automobile. But when production techniques brought the price down,

and the support items like tires, petroleum, and road construction grew up around the automobile, the value and the cost gradually came into balance. And as the general public saw the auto come within their economic reach, new needs were identified. So it will be with computers in education.

Some of the mistakes vendors have made were to force technology into areas not yet ready for it. Innovation and entrepreneurship have been described as having three critical characteristics. First is "the next logical step." When entrepreneurs make an advance, these are understood as logically in sequence from the previous one. Second, the step is reversible. If it does not work, one can reverse it with minimal negative consequence. Third, the step uses "sunk funding," material already bought: it does not require you to rip out and start new. I view AT&T's approach to technology in schools in this manner. Our approach is the next logical step, a school can reverse a decision with little negative consequence, and our method allows a school to use "sunk funding."

Technological breakthroughs and production techniques are consistently bringing the prices of computers down. Support industries like courseware developers, distribution technology, and publishing, are growing rapidly. Cries of "Get a blackboard!" are waning. Those who have not yet seen the value of technology in the educational process soon will, and AT&T has every intention of being around when that happens, because I believe we offer the next logical step.

THE SCHOOL OF THE FUTURE*

Judith Johns Hubner
Director
California "Computers in Schools" Project

The meaning of the short-lived flight of the space shuttle Challenger was not only as a tragedy, but also the reality that such a voyage is possible, a reality made possible by powerful new electronic resources. Computers, television, and satellites have changed our understanding of the nature of time and distance. Speed-of-light computer electronics have compressed time to reduce the timeline for achievements in space science from decades to months. Electronic telecommunications now deliver television images from shuttle and satellites in microseconds. Through distance-insensitive electronic signals, an earth-based controller can maneuver a satellite with more precision than the operator of a school bus can back into a parking space in the school parking lot.

Christa McAuliffe's courageous journey serves as a symbolic challenge to the school community to climb aboard the electronic age. To keep pace with America's new industrial-economic power, the school community cannot sit by waiting for the emergence of appropriate electronic tools. Educators must take responsibility for developing new applications which augment the learning environment. This does not require inventing new technologies, but rather integrating the technologies that already exist into daily classroom practices.

As people experience life in the Information Age, they will be asking

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* Revision of a presentation to the San Francisco Foundation, 1985.

schools to serve a new array of purposes. For example, K-12 education will be asked to empower students to participate in a life-long learning process. The traditional division between school and work will lose its rigidity as students can no longer anticipate a single lifetime career. Employment will no longer be the end of schooling, but will itself become a learning experience. Retraining of skills and restructuring of knowledge will be necessary parts of continued employment. Within the next ten years, we face the responsibility of redesigning the learning experience for the individual student, defining again the role of the teacher and the student, and creating new pathways for exchanges between schools and the society as a whole.

AN URGENT NEED

If the schools fail to incorporate the new technologies into their instructional systems, they will not be able to equip today's students to participate in the socio-economic structures of the future. America is in transition from an industrial society to a post-industrial culture. Computer-robotic augmented manufacturing and service facilities create new demands on the school system. Our industrial and commercial sectors are achieving generational changes in fewer years than it takes to advance from kindergarten through high school. Schools must respond by enhancing the resourcefulness of their students, preparing them to absorb new training quickly, and to develop new skills to meet unforeseen changes in the employment market.

Furthermore, computers and robotics are displacing people as the working resource. New technologies are continuously being developed to reduce the need for human labor at increasingly complex and sophisticated tasks. As the need

for labor-intensive activity is eliminated from our economy, a new level of literacy will be required of the work force. Not only reading and writing, but technological literacy will also be necessary. Not only number facts and computational skills, but problem solving, critical thinking, and information utilization skills will be needed.

Electronic technologies will complement but not replace teachers. The most sophisticated programming can not equip a machine to achieve the diagnostic sensitivity of a highly gifted human teacher. On the other hand, machines can be programmed to relieve many of the time-consuming routine demands on teachers. They can increase teacher flexibility and productivity and enable them to work more effectively with students. If teachers do not have the electronic tools to take over a substantial portion of their routine instruction and management, they will not have the time or flexibility to prepare their students for the challenges ahead.

If our schools fail to incorporate the time-compressing, distance-bridging electronic technologies, large segments of the population will leave school unskilled and unequipped to contribute to the new socio-economic structures. The result could be continuing unemployment, a disgruntled and disillusioned population, and levels of dependency so high as to threaten our entire political system.

THE SCHOOL OF THE ELECTRONIC AGE

The school of the future will encompass resource centers, learning labs, guidance centers, and peer-group meeting rooms. Highly skilled teachers and management personnel will coordinate the school as a multi-media network. The onsite network will be linked to external teaching and learning environments, as well as to all social service providers, employment opportunity specialists

and income-producing resources.

Text books and library books, film strips and slides, draft shops and band rooms, dance rooms and gyms, will continue to serve as physical resources. But the electronic connectors will bring them all into new living interrelationships as the students use electronic technologies to reach around and beyond the school's boundaries.

The keyboard at every student's fingertips will be the control panel for all the supporting peripherals. These will include input-output monitors for computer information exchange, video monitors and tape recorders, roof-top dish transceivers linked to direct-access satellites and switchable sky-bridge connectors.

Each individual learner will have access to arts, culture, mechanics, music, sciences from anywhere in the world. Electronics will break the bonds of horizons and expand each student's vision to orbit the globe. Interactive television and computer-based telecommunications will connect students with an international network. As these new relationships become a vital reality, old stereotypes and prejudices will be discarded.

The electronic capability to organize information will enhance productivity. As students collaborate in developing electronic resources, they will develop higher-order communication skills. The outcome will be the creation of new levels of knowledge.

Flexible scheduling, teacher guided and electronically managed, will enable students to choose the most appropriate study environment for the task at hand. Study time may be spent working in various locations, alone, in pairs, in groups, or in one-to-one interactions with teachers.

Matching education to each learner's unique needs, pace, and style has long been a dream, but not an affordable reality in our traditional school environments. Interactive technologies--computers, video-disc players, remote databases--now make this possible. They can be programmed to adjust to each learner as they present new information, discover knowledge-gaps and remediate with uncritical patience. By individualizing instruction, the electronic age brings us within the grasp of a truly democratic educational system.

ENABLING CONDITIONS

A critical factor in bringing the schools into the electronic age is to use technology to redefine equality of opportunity. Freedom to pursue one's aspirations not only means the opportunity to span new horizons, but an assurance that the necessary tools and information are available.

Committed to our founding father's philosophy of excellence and equity, we need to move boldly into this transition period. We need to diminish fear of change and reclaim the pioneering spirit of our forebears. We need to preserve the accumulated wisdom we have gained from two centuries of American education. We can move forward, practicing the best of our common sense as we look again at management and evaluation, curriculum, and the roles of teachers and the community.

We will need:

1. Management devices to track student achievement electronically. We must insure that the appropriate competencies are achieved, that new opportunities are explored, and that new challenges are pursued.

2. Evaluation procedures to provide the continuous review of content and methodology. These procedures will need built-in flexibility to respond to the emerging developments of the socio-economic structure external to the schools.
3. Curriculum committees working together to integrate the new cross-disciplinary subjects. New dimensions will be needed to enlarge the scope of curricula to a new global perspective. Older programs must be restructured and adapted to the electronic delivery systems.
4. A redefinition of teachers' roles. Teachers must be retrained as educators who guide, facilitate, integrate, stimulate, and affirm the students' self-managed learning.
5. Cooperation with experts to ensure that educators keep up with the innovations of technology in business, industry, university, and government. This should include exchange programs to enable students and teachers to schedule participation in work-experiences and community services.

CONCLUSION

The School of the Future can not be realized all at once, but it can be brought into reality if there is commitment and a willingness to act. As the moon landing taught us, the first step is often the biggest. Once the first step has been taken, and a track has been made, others will be able to benefit from, and pattern after, the first courageous explorers.

THE PAST AS INVITATION:
THE VIDEO ENCYCLOPEDIA OF THE 20TH CENTURY

Roger B. Fransecky
President, CEL Educational Resources
CEL Communications, Inc.

THE PAST AS PROLOGUE

I believe that I have seen the future, and it is visual, or at least visible to any of us grappling with the present and hungry for a more articulate sense of what lies ahead. Our resource, The Video Encyclopedia of the 20th Century, invites students to relocate themselves in something other than the moment, to travel outside their time and place to discover the richest, most personal lessons of our shared history as world citizens. The lessons for us as the creators of this particular set of learning adventures provide a useful counterpoint to the theme of this conference.

In 1963, Mert Koplin, our chairman and the intellectual architect of our national educational effort, and his partner, Charles Grinker, set out to correct a wrong they discovered in their years as network television documentary producers. They had always imagined that somewhere, in some government agency, some deep mountain vault, some museum--someone had set about to collect and arrange the significant people and events of the only century ever captured on film and videotape. When they realized that this was not so, a living visual archive project became their mission, and I stand here today to confirm their success. CEL (founded as The Corporation for Entertainment and Learning) Communications has succeeded in collecting, editing, producing, and archiving one of the largest private collections of historic film and video in the world, a resource we have utilized as the

basis of our prime time television programming including "A Walk Through the 20th Century with Bill Moyers," and "Creativity." With Koplin's persistent prodding, we have spent several years developing a comprehensive form of our collection for schools, colleges, and libraries, and after a year of national piloting and testing, we released The Video Encyclopedia of the 20th Century April, 1986.

The response to this resource has been heartwarming, and with appropriate apologies to Secretary Bennett, the "first lessons" have nudged our best thinking, our brightest teachers, and our visually-literate students to discover the texture and tapestry of collective history.

Many feel that students confront a history that numbs their very sense of the possible. Our retinas are used to the collective imaging of nearly eight hours of daily television viewing after seven hours in school. In an effort to introduce a comprehensive video resource that taps a youngster's inherent fascination with television, we have stimulated provocative classroom practice, rejuvenated teachers, and generated increased awareness that history did not begin that morning.

THE VIDEO ENCYCLOPEDIA OF THE 20TH CENTURY

The Video Encyclopedia of the 20th Century is a comprehensive video resource consisting of seventy-five hours of original film material, arranged chronologically from 1893-1985 in 75 videotapes or 38 videodiscs. The entire collection is supported by nearly three-thousand pages of print reference documentation providing essential details on the resource base of 2,217 units. The Video Encyclopedia index contains 15,000 entries in a subject, topic, and daily system. We have just released a two-hour "Update" for 1985, and we intend a three-hour set of "Enrichment Volumes"

in January, 1987, so we will have issued nearly 80 hours of material. The entire collection (on videotape and videodisc) is the largest collection yet released on videodisc and is duplicable by our users for the custom development of school-specific instructional development, including the unusual right to broadcast/narrowcast the material on closed circuit, institutional loops, and cable television. The Video Encyclopedia is also the subject of interactive videodisc-computer experiments, such as the one at Teachers College, Columbia University which is developing a computer-based index and videodisc retrieval system using IBM's "Handy" authoring language.

FIRST LESSONS

In our work in schools, colleges, libraries, and other institutions, we have attempted to develop unique local program alliances to develop specific curriculum materials that help teachers and students using The Video Encyclopedia enrich the teaching of language skills, social studies, and science. Our work at Fordham's Graduate School of Education has yielded a comprehensive analysis of the statewide K-12 social studies curriculums for New York, Texas, and California that further guides our research and program development. We have also instituted a national 800 hotline for teachers to extend our instructional support activities, including the more traditional inservice training programs, site-specific curriculum materials, and our national bimonthly "Newsletter."

We have to agree with Secretary Bennett's expressed concerns in "First Lessons":

> "In our time, in this land, democratic citizenship requires an array of knowledge and skills; a common language through which we can all communicate, an understanding of our civilization and

> its institutions, knowledge of our national symbols, a grasp of America's unique cultural pluralism and respect for people from different backgrounds to live together as Americans."

We embrace these goals for our students, but as educators, instructional developers, and publishers, we are also aware of the grim reality of the urban classroom where a teacher uses media within a crowded, difficult instructional environment.

Our goal is to help teachers teach with solidly conceived, well-documented and tightly arranged materials framed within a formal instructional system. Yet we face one constraint. The Video Encyclopedia (and other related materials) must be used "intentionally," for they are not traditional audio-visual resources. Their compelling invitation will never be discovered unless a teacher plans for their use within the instructional program. That is why we have invested in collaboratively developed curriculum materials in many of our urban school sites.

IT IS MORE THAN HISTORY

The Video Encyclopedia is designed to support a broad range of language activities, research, production, and inquiry-centered student programs and projects. In no sense is The Video Encyclopedia only used to enrich our traditional (and I might add occasionally terminally book-bound) teaching of history. We have had spectacular response from language arts teachers who use The Video Encyclopedia units to provide contextual information to teach writing or provoke genre study. One New York City teacher used the unit on the 1939 World's Fair to help students "experience" E. L. Doctorow's inspiration for his novel. Having said that, let me also say The Video Encyclopedia has given new and compelling reality to the lessons of history. The stakes are high if we do not make history, by whatever name, come alive

in the lives and values of our students. Historian Arthur Schlesinger, Jr. notes in his wonderful new collection of essays, The Cycles of American History that "historians don't seem to speak to the culture as once they did." Schlesinger argues that we must have some sense "of what this country has been about, of the available traditions. The sense of the richness of the American past improve the intelligence of the choices we make about the American future. History is to the nation what memory is to the individual. Without memory, the individual would be absolutely rudderless." The Video Encyclopedia contributes to this sense of memory.

THE PROBLEMS AHEAD

Whatever our hope that the enlightened use of instructional technology will provoke better teaching and support richer learning opportunities, the tough truth is that in a constrained fiscal climate, technology and the software systems it uses must be cost effective, linked to the realities of the classroom, and usable by students and teachers. I would also argue that any educational program must stand the test of sound evaluation, frequent updating, and constructive feedback from it main users: students. A national propensity for hyperbole has inflated the genuine utility and cost in teacher and student time of many of our "innovative" programs.

The recently published America in Perspective by Oxford Analytica, an international research and consulting organization based in Oxford, England presents a range of disturbing scenarios for our nation. The authors propose that Americans are divorced from reality, that we have not learned from our history. They note that in our past we held out "the promise of continuing material advance . . . free from the threat of major class divisions." But

now, they tell us, that era is over. "The American dream will fade for most Americans . . . the gap between the haves and the have-nots will widen while class lines are likely to become clearer and class barriers harder to leap." It is easy, and perhaps foolhardy, to risk dismissing the Oxford group as patronizing their Yankee cousins. This report and others present a dismal prospect regarding future options, and some potential "second lessons" for all of us who share the responsibility of education in America.

Any analysis of schooling must contain our best thinking about the need for common goals, shared agendas, and powerful alliances. The growing public-private sector partnership initiatives to provide new resources to urban schools (New York City, Detroit, Atlanta) seem to hold promise for more creative potential and real-dollar support. But that is only the beginning. This conference suggests another essential partnership--between those of you that manage our schools, our states, our universities, and those of us who produce the technologies and instructional materials your students and teachers will use.

INFORMATION RETRIEVAL AND THE COMPUTER

Ronald J. Boehm
President
American Bibliographic Center-CLIO Publishing

Information retrieval as an educational subject should be ranked on a par with reading, writing, and mathematics. Students are generally taught skills and values or perspectives which allow the best use of those skills, but it is often the case that the student has a difficult time commanding the skills necessary to develop or even survive in our society. One reason for this may be the absence of instruction that affords an information perspective and associated skills, specifically the value of information, information retrieval skills (locating, selecting, obtaining), and information application (classifying, prioritizing, critical thinking, communicating). A complete education requires the inclusion of information instruction in the school curriculum.

We hear constantly that we are living in a society growing ever richer in information. This is true, but misleading. A society whose average wealth is increasing is not better off if there is increased polarization between the rich and the poor. In terms of our society's wealth of information, there is a strong trend toward polarization between the "information-haves" and the "have-nots." This is because those persons who do not understand the value of information do not develop information-seeking habits; they never know what they are missing and as a result remain information poor; whereas those who do understand the value of information develop the proper skills and become ever richer.

To give one example of the value of information, consider the individual who does not know what her rights or options are and does not know where to find out. This is a typical information retrieval problem. This person has to know first that she is ignorant of her rights or options, and second, has to know a systematic way of finding answers to her questions. Apply the above facts to any number of common situations: abortion, wife abuse, or injury to her family in a traffic accident. If she is ignorant about her rights or does not have the necessary information retrieval skills, that person will be victimized throughout her life.

It is said that the beginning of knowledge and wisdom is the awareness of ignorance. An awareness of ignorance can often be created merely by exposing people to what they do not know and demonstrating where such knowledge would be valuable to them. Teaching the value of anything, whether it is money, education, or information, leads to a desire to increase the possession of that valued item. Because it is impossible to know everything, the next best alternative is to realize that useful information about almost everything does exist and that certain skills can be utilized to obtain that information. Skills then become the means to an end, rather than an end in and of themselves.

Teaching information skills then involves three steps:

1. Create an awareness of what information is available.
2. Create an understanding of how information can be applied to a variety of situations.
3. Teach information retrieval and application skills.

The first two steps help the student understand the value of information. A student can be exposed to the wealth and breadth of available information

through the computer that offers a window into the hundreds of databases rarely available in printed form.

The breadth of information available electronically is staggering. There are hundreds of databases covering every imaginable topic. Yet the computer has the ability to quickly pinpoint relevant information for the user if the user has the proper skills. In addition, electronic bulletin boards allow access to human experts on many topics that can help find relevant information and help sort out what can seem like an information overload.

The second step in teaching the value of information is to show how such information can be applied to every task or job. For example, the value of information can be taught through case studies comparing situations where the individuals, companies, or institutions did or did not have relevant information. Additionally, role playing in a negotiation situation, for example, provides a stage where two sides are given objectives, but only one side is given information which is important to those objectives.

The third step is the development of skills. I have talked to many educators involved with teaching online information retrieval and computer skills at all levels. They are unanimous in stating that computer skills should be oriented to enhancing the basic curriculum. Simply studying how a computer works is not critical to a good education. Indeed one educator said that studying the computer for its own sake is about as useful as studying refrigerators. Programming makes a nice hobby, and students

should have an opportunity to learn it if they want to, but it should not be a mainstream application of education dollars. I have found it not uncommon for high school library budgets to be less than two dollars per student per year, yet time and dollars are spent on classes that teach programming.

In the area of teaching information skills, there are many people and institutions who are making this easier and more cost effective. Online information distributors such as DIALOG, BRS, Dow Jones, H.W. Wilson, the SOURCE, COMPUSERVE, and others are heavily subsidizing the use of their on-line systems for educational purposes because it is in their interest to have students develop an information habit. Additionally, these distributors are providing training for teachers and librarians so that they in turn can teach the students.

Publishers and the online distributors are providing materials and workbooks which make the teaching of these skills easier. There is a growing literature base providing examples of how and why programs were implemented. ABC-CLIO is coming out with a series of books about online usage in schools, and we look forward to the educational experience these materials will create regarding the subject of information retrieval.

Each publisher and program, however, focuses too narrowly on their own specific educational materials. This may lead to some slighting of the general skills necessary for electronic information retrieval. In order to standardize information retrieval as an essential part of the school curriculum, certain guidelines are needed to afford a foundation for instruction.

First, the research must define the topic of interest in terms that can

be understood by the database and the distributor's search program. There are several learning steps here, including use of the proper subject terminology and the proper selection language for the search. We are working with the University of Southern California to develop an expert program to allow a high school student or college freshman to handle these problems easily.

Next comes selection of the proper database or other electronic resource, and learning the peculiarities of accessing a particular database or information retrieval system. The key skill which must be taught and exercised frequently is the ability to ask the right questions.

Finally, there is the task of obtaining the printed material from the search. If the information retrieved in the search is primary, that is, directly usable information, the information must be captured and printed out. If it is secondary, or bibliographic information, the student must "close the loop" by obtaining the actual articles or books from conventional library sources. Pennsylvania is one state which is developing an online system which greatly facilitates resource sharing among the state universities, public libraries, and high schools.

Note that these information retrieval skills can be applied to all electronic information services: they are independent of technology and can be used with online services, CD-Roms, and even print products. We have contributed our data to a database training project, put together by Scholastic, which allows students to practice asking the right questions in the right manner while offline and allows them to create their own databases.

Once the information has been retrieved, it can be applied to complete a particular assignment or project. This includes classifying, prioritizing,

sorting through potential biases, applying critical thinking skills, and communicating the outcome.

Consider the traditional high school research paper in social studies. Too often the information resources are the encyclopedia and a few articles. The student focuses primarily on communicating, through a written or oral report, a summary of what he has read. Little is learned about general information retrieval skills; and because the print information resources do not lend themselves to complex analyses or comparisons, little opportunity for critical thinking exists.

An electronic search, on the other hand, can span far larger resources and can seek out unusual and creative relationships in just a few seconds. It can quickly provide information or leads that will take a student through a full spectrum of information and retrieval skills. Critical thinking skills can be applied to what conceivably is "new" research, rather than recopied material. Think of the power of such motivational and educational tools in the hands of a skilled teacher.

There exists a tremendous opportunity for leadership in creating an educational context for information. You can make sure that students learn the value of information as well as the skills necessary for its mastery. Thus, you can insure that funds for computer projects are well used and their educational objectives are achieved. And remember there are many information resources to draw on to help administrators and teachers chart an effective, cost efficient course.

A disservice would be done to those who helped me prepare this paper if I did not bring up a point made by almost all of them. The librarian is the one person in the school to whom information retrieval is

second nature. Yet the potential of the teacher and the librarian cooperatively bringing information skills to students often does not develop because of political or turf problems. This is where leadership from a high level can provide focus and direction that make the best use of existing personnel and resources.

Moreover, students themselves represent an important resource in the development of effective information retrieval instruction in the schools. A good example comes from Vermont where a group of high school students, in a "bootstrapping" operation, used a computer to install public domain bulletin board software. They put together their own dial-in bulletin board for students by loading information of interest, including databases they had developed on their own, and gave any student a password to access the system. The students continue to run the system themselves, although they now have a faculty advisor. Their bulletin board is in use from early morning to late at night.

This grass-roots effort was strengthened by the Department of Education having students set up similar bulletin boards in all telephone exchanges so that a student board is only a local call away to students using computers at school or at home. They arranged for the students to train faculty advisors from other high schools and arranged the donation of several microcomputers to serve as hosts for the bulletin boards. The Department of Education sees tremendous potential in reaching students in remote areas, but perhaps the best educational experience was for the students who became excited about the project and used a variety of information skills to see how far they could push their project.

The computer is a valuable tool in reaching educational objectives.

Grass-roots efforts, however, can only carry a project so far. Top level guidance is needed both to maintain focus and to strengthen initial efforts.

TECHNOLOGY AND THE STUDENT'S EDUCATION

John Vasconcellos
California State Assemblyman
Chairman, Ways and Means Committee

In my more than twenty years of experience as a legislator, with a special concern for education, I have learned not to accept solutions to problems that serve nothing more than current fashions. I want to be on the frontier of change. But when subjects like technology and education are under review, my interest is always centered on what happens to the student during his or her tenure in our California schools. I want to be assured that the young people we are educating emerge from our schools as citizens who have cultivated a sense of individuality, self-sufficiency, and community. Each expenditure and commitment we make either to programs or personnel must be evaluated against these measures of achievement. These are the measures of real success in education.

Computers, of course, can be very valuable in educating our youth. I come from Silicon Valley, a place most people believe is the computer capital of the world. We have worked in the California legislature to get the funding of our statutory model computer programs and to establish a basis of dissemination of what is best to school districts all around the state. So it is important to me that computers be used appropriately. But the test is how computers enhance the broadest concept of the education of our students.

In looking at the educational issues that have been current in California for the past eight to ten years, we have spent more than a

billion dollars for various programs always labelled reforms. Those reforms seemed fine to me, but in retrospect they were never sufficient. For instance, expanding instructional hours and lengthening the school day did not ask what was happening to the courses taught. Did students perform better or worse with each successive change? I discovered that if an educational program was bad to start with, successive reforms only made the situation worse, rather than better. We did not get at the root of educational experience. We later added tests and graduation standards and altered what I call the external factors of education without improving sufficiently the quality of learning. In fact, many of our legislative initiatives were not productive forces in a student's development. I speak as the son of a school teacher and superintendent and as a person who got every possible grade and award for outstanding performance. I was the class valedictorian, but I knew little else about myself, my purpose in life, and the values I hoped to propagate. This is not an overstatement, but an accurate description of who I was at least twenty years ago.

At first the idea of reform represented a get-tough attitude toward schooling, and I think it made some sense in the past. Our greatest need then was to be sure that excellence was highlighted and not abandoned in favor of equity or other admirable considerations. Now we are in the second wave of educational reform. It is the Carnegie Commission nationally and the Commons Commission in California, both focusing on teachers and the need to improve the teaching profession. Each recommends more prerogatives for teacher, improved compensation, and greater authority for those who teach. Overall, the reports demand recognition for the teacher's role in our society.

As I read the Commons report and the Carnegie report, however, I could not find sufficient mention of our youth in either one of them. It left me a bit worried about what we are really talking about. It seems to me that we have forgotten, by concentrating on what I called earlier the external factors of education, about what happens between teacher and student: Why does a young person become curious? How do we sustain this instinct? What methods are best to make students independent, self-initiating learners? Can we help students discover who they are and what they should be? How do we nurture a meaningful set of values as well as intellectual competencies?

I know from personal experience that these are vital questions. Two years ago, I dropped out for a while with a heart attack and bypass surgery. My college classmate took me in and I shared a wing in his home with his son Michael, who was twelve and a genius with computers. Fortunately, before he received a computer, Michael got lots of love and attention and became a clear thinking, confident, comfortable person. He is now fifteen, and he has not lost his innocence. Technology can obviously help students learn by providing information and new ways of doing things quickly. But the capacity to benefit from computers is dependent on the pre-existing educational attributes of each student and his relationship to effective teachers.

My comments are meaningful only when they get to the basic issues regarding what I call the interior of education. The essential question is, how does real learning occur? What kinds of persons and what type of development and training enables teachers to realize their potential? I believe students need more than cognitive and analytical skills. I want

our schools to educate citizens who graduate with a sense of personal self-esteem. We want Americans who know how to make independent judgments, without fear of intimidation or authority. From this perspective, computers and education should not mean being a slave to a machine, but ability to use a machine in order to make the greatest use of one's intellect. The capacity of machines can never outrun the capacity of people to learn.

I think computers should be recognized as means and not as ends in themselves. Our educational priorities should begin with the student, the teacher, and only later the utilization of computers in instruction. Let computer technology support that exploration and that process which enhances the learning competencies of our youth. I am not decrying the use of technology; I think it has great potential. I just worry about technology getting ahead of the rest of us.

ISSUES IN TEACHING WITH TECHNOLOGY: AMERICAN FEDERATION OF TEACHERS' PERSPECTIVE

David H. Florio
Director, Policy Development
American Federation of Teachers

The number of computers in schools is growing exponentially. This "revolution" was launched in the manner of a typical education fad. It was pushed from outside, with little time for planning, few opportunities to integrate the innovation with school programs or adapt it to local situations, and little or no teacher input into the selection of equipment or material. In fact, the "movement" was led by affluent parents who were worried that their offspring would be left behind in the new high tech, high skill post-industrial economy.

The American Federation of Teachers views educational technology as a potential basic tool in the school reform movement. The AFT supports the use of "a variety of informational technologies" in learning-centered schools designed so that the best practices drive structure and function.

The American Federation of Teachers is rapidly expanding its role as a professional teachers' union. AFT continues to work for members' improved wages, hours, and working conditions and guards their due process rights. AFT also works to meet the full professional aspirations of its current and future members. This expanded role includes efforts to change the nature and operation of schooling. If public education is to serve the economic and social needs of the nation, it must attract and retain effective and creative teachers in a restructured, learning-centered school.

The future of public education, students, and teachers depends on the successful integration of three major education movements: the radical restructuring of both schools and the teaching profession (outlined in recent reports by the Carnegie Commission on Education and the Economy, the AFT, and the National Governors' Association); the campaign to reach, teach, and retain in successful educational programs those students who are most at risk; and the integration of advanced information technologies into educational programs and appropriate school curricula.

Technology cannot be used as a successful tool without new school organization structures. The restructured, learning-centered school cannot be achieved without more effective, rapid, and interesting ways to communicate, to access knowledge, and to teach. All of these objectives lie within the potential of educational technology when integrated with school programs.

ALTERNATIVE FUTURES

Educational technology, at the core of the much needed revolution in American education, presents dramatic opportunities and dangers for both students and teachers. Its use or abuse will determine if the education revolution can be won. Efforts to apply information technologies will determine alternative futures in American public education if they:

a. Provide students with earlier, faster, and more sophisticated learning opportunities, or retard educational advancement because of their misapplication.

b. Give teachers control over the major learning tools used by students and teachers, or reduce the already limited autonomy and professional judgments of teachers acting under the force

of new technologies imposed from above.

c. Provide teachers with an important tool for educational advancement and professional effectiveness, or be another educational fad which comes and goes with a significant loss of human and material capital.

d. Increase the credibility of teachers and public schools as models for appropriate applications of new technologies; or increase public pressure to find alternatives to the public schools, strengthening the advocates of "privatization" of schooling and home learning.

e. Increase the ability of teachers to motivate and assist students in "at-risk" populations or who are failing in the current school setting; or contribute to greater learning gaps between rich and poor, city and suburb, girls and boys, majority and minority.

f. See teacher unions, who represent about 90 percent of all teachers, take a leading role in the effort to implement appropriate applications of technologies through local and state political and representational power; or see local unions and their state organizations block or obstruct the application of inappropriate, imposed educational technologies.

Mistakes and Needed Explanations

For the most part, schools have responded to the technology revolution as they have in the past. They isolated the intervention in separate laboratories or computer rooms. Instructional use was narrow and limited to a few students.

It is clear among scholars and other observers of educational technology that significant miscalculations have already been made. With limited numbers of computers and trained staff, most schools initially used the computer to teach about the computer. It was falsely assumed that both students and teachers would have to be "technically computer literate" in order to prepare for the future worlds of education and work.

The limited vision and misconceptions of early practice can and must be corrected. Teachers and administrators at school must have a full grasp of the new technology's range and capacity. They should also understand the appropriate use of these technologies and how they compare to alternative instructional and learning methods.

First, those closest to the learning process, teachers, students, and other school instructional personnel, must have the time for training and experimenting with interactive information systems, and other educational technologies. Only with grass-roots understanding, development, and application will there be an integration of technology with public education.

Second, we must use great care in the language and explanations that are presented to teachers and school staff. Many teachers remember "teacher-proof" curricula and machines. In addition, there is a potential for fear-mongering as technology advocates talk of replacing "bad teachers" and "cutting costs" with more "efficient" methods. Successful adoption of learning technologies requires teachers and school administrators to view these instruments as important, helpful tools.

Third, the technology should be flexible enough to accommodate any among a full spectrum of educational philosophies: direct instruction,

open-ended exploration, and guided problem-solving. Attempts to "sell" the technology by advocating a specific philosophy or instructional strategy will meet appropriate resistance. Teachers and education scholars know that learning requires a variety of strategies depending on subject, curricula, level, student maturity, and so on.

Fourth, the types and kinds of advanced information technologies reach far beyond the microcomputer and floppy disk. Interactive video and audio, database management-storage-retrieval systems, electronic ma[illegible], VCR's, and compact disk players are all parts of a new teaching and learning constellation.

Fifth, the notion that technical literacy is basic to the appropriate use of instructional technology is similar to believing that you have to be a mechanic in order to drive a car. Programming and computer expertise are appropriate for a subset of students interested in computer science and related fields. Hardware and software advances have made numerous applications technology possible without users having extensive technical knowledge and programming skills. A more important challenge is the design and application of software to integrate new technologies with academic curricula.

Lastly, the movement to apply new information technologies to education must parallel current efforts to reform the teaching profession and restructure schools. Only when there is adequate time to plan and implement instructional programs using new technologies will there be lasting effects. That time will only be available in a school structured to accommodate appropriate technological application.

THE PROMISE

The current school structure with a classroom, a teacher, 20 to 35 students, and a fragmented curricula, already thwarts what we know about best practice. The potential of the new technology is to increase the effective and timely learning of students. About 85 percent of a secondary teacher's time is spent delivering information. Information technologies are capable of quickly providing a great variety of interesting information. This will free teachers to coach, diagnose, and individualize learning programs.

The promise is outlined in the recent National Governors Association report, Time for Results (1986), p. 123. Appropriate technologies can improve: (a) effective higher order thinking instruction, (b) coaching and tutoring, (c) access and ability to manipulate information through computerized databases and interactive communications, (d) drill and practice with corrective feedback, (e) data about school conditions and performance, (f) opportunities for handicapped children, and (g) productivity through practical experiments with new school structures and staffing strategies.

THE ROLE OF TEACHERS AND THEIR UNIONS

But we should remember there are major barriers to the appropriate application of educational technology that originate with the potential users--school personnel. These barriers include lack of planning, lack of time to develop understanding, failure to form a consensus about the most effective application, lack of training and participation in decisions about use, and the failure to integrate the technologies with the core curriculum of the schools.

If innovatively applied and integrated with redesigned school curricula and instructional programs, the advanced information technologies will allow

the best practices to drive school structure rather than allowing structure to limit those practices.

The American Federation of Teachers, at the local, state, and national levels, is taking strong measures to ensure that information technologies are successfully integrated into the public schools. AFT has endorsed the Carnegie Commission report, A Nation Prepared (May, 1986), and adopted its own policy statement, "The Revolution that is Overdue," calling for the integration of technology in the restructured, learning-centered school.

The AFT is working to make teachers aware of the range of alternative educational technologies and their appropriate application. AFT is also encouraging its local affiliates, through collective bargaining or cooperative agreements with local boards and administrators, to work for teacher participation in all phases of educational reform including the use information technologies.

AFT is encouraging local affiliates to provide for flexibility in local contracts to allow for experimental programs in the schools, experiments with technology that will include alternative staffing and organizational arrangements. AFT will work to affect state and federal legislation which will provide incentives and resources for needed education reforms, including educational technology, in the schools.

NEW YORK STATE UNITED TEACHERS--AFT IN ACTION

The New York State United Teachers (NYSUT/AFT) has established a task force on educational technology. This task force has recommended principles and policies for the state union. They reflect issues and problems facing teachers attempting to make sure that new information technologies are productive and advance the learning process.

The NYSUT task force recognizes that teachers have not been adequately involved in the introduction, selection, adaptation, or evaluation of school technology. Yet teachers, often without adequate training or understanding, are expected to implement education programs using computers and other forms of technology. As noted, this situation has already led to many misapplications of the technologies. Therefore, the following principles will guide the NYSUT state legislative program and policies for local NYSUT affiliates:

1. The primary goals of new learning technologies must be the enhancement of learning and teaching; therefore, any application of educational technology should be integrated with appropriate curricula at the school site (not isolated from the academic program of the schools).
2. Cost, in time and money, and other effects, including comparisons with other instructional strategies, must be taken into account before new technologies are adopted and put into the schools.
3. Teachers and other staff members responsible for the use of new technology must be involved in all phases of its design, implementation, and evaluation. Such empowerment should be mandated by state law to apply to the development of legislation, laws, regulations, and at the local level through collective bargaining contracts.
4. Technology must be seen as a means of expanding the capacities of teachers and other school personnel. NYSUT recommendations endorse the statement of Governor John Sununu of New Hampshire, chair of the Governors Task Force on Technology:

> "While the computer in the classroom has often occupied center stage, other technologies are equally important. Applied technology can accomplish much, but only when it supplements and complements the capacity of the teacher. Technology is not a replacement for, or an alternative to, professionals in the classroom." (Time for Results, National Governors Association, August, 1986, p.122.)

5. Decisions regarding the actual application of technologies should be made at the school with teachers given the needed preparation and understanding to make informed judgments about technological applications.

In addition to these principles, the NYSUT task force is recommending that the NYSUT adopt a legislative and policy plan which will (1) increase the evaluation and review of hardware and software; (2) eliminate separate "computer teacher" certification; and (3) increase the access and use of new technologies among poor school districts and those serving large numbers of students from low income families or who fall in high risk categories.

LOOKING FOR ALLIES

Information technologies can serve the education revolution on several fronts: they provide new chances for students at risk; they enhance student and teacher performance; and they help to produce school achievements which gain public respect and political support for schools and teachers.

Technology will empower students to take more control of their own learning. Teachers will require more extensive knowledge of subject matter and pedogogy. If we are to recruit and keep such teachers, we need new school structures and a teaching career path that keeps effective teachers in schools.

AFT is looking for allies in the education reform movement. New learning technologies can be important resources in the fight for teacher

professionalism. If misapplied or marketed without careful thought and planning, however, they can be a barrier to much needed improvements in teaching and learning. We call upon policy-makers, the private sector, educators, and producers of hardware and software to join in the education revolution. The choices are before us. We must accept the challenge.

ISSUES IN TEACHING WITH TECHNOLOGY: NATIONAL SCHOOL BOARDS' PERSPECTIVE

James A. Mecklenburger
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National School Boards Association

Often when I speak publicly, I use Star Wars in the Classroom as the title of my presentation. I offer it to school boards and other listeners as a possible metaphor they might use, a better theme than "A Nation at Risk," "Excellence in Education," "Reforming the Teaching Profession," or "Transforming American Education."

Star Wars in the Classroom may not be the best approach, ultimately. But it demonstrates what an effective political movement should say about education today. We need:

- to create a bold program
- to exploit the nation's best minds and best technologies
- to see education as part of the nation's defense
- to develop a level of education more perfect and more daring than anything we have achieved before
- to preserve the tradition of school but not necessarily its conventional forms

Our political and education leaders are struggling to articulate a vision where education must go. Leaders have been impressed by the importance of new technology for education; but they have not yet expressed how they would shape both schools and technology in order to capture technology's significance. Instead, their frame of reference continues to be the present schooling system which necessarily relegates technology to a supplementary role.

In the present system, classrooms define our use of space; books define our organization of information; courses and credits and students' age define our use of time; paper-and-pencil tests define our measures of outcome. Moreover, teachers lecturing and students listening is the dominant pedagogical method. For the most part, our acceptance of technology in schools has been conditioned by technology as a supplement to the major methods of schooling.

To be sure, for a century we have used radio, TV, film, and tape as occasional tools to supplement learning in school. We accept, within limits, the belief that such supplements can make for better classrooms, better books (or electronic equivalents), wiser courses of study, better tests, and more engaging teacher presentations to students. This view went virtually unquestioned in A Nation at Risk in 1983. That report calls for major efforts to improve books, courses, tests, and teachers. Only incidentally does it urge that we buy some computers to teach "Computer Literacy."

The two widely heeded reports of 1986, A Nation Prepared and Time for Results, reveal a greater willingness to question the conventional school learning structure supplemented by computers. Both reports, and Time for Results particularly, assert that technology can make teachers and students more productive. Time for Results states that if schools emulate the business approach to technology, technology would not merely supplement education but would make schools more efficient, more effective, and more productive. Both reports mention not only computer technology but video and videodisc instruction, telecommunications, and software technologies such as word processing and artificial intelligence.

The major thrust of these two most recent reports is upon improving the

teacher cadre. Technology is instrumental but not central to their thinking about how to improve education. Among all the various commentaries, only a less known report, Transforming American Education (produced as a sequel to A Nation at Risk), argues that technology should be central to the improvement of schools.

Within the organized community of the nation's local school boards, there is more sympathy for the centrality of technology than has been evident in the communities of teachers or administrators. For example, only the National School Boards Association (NSBA) published the entire text of Transforming American Education in its national newspaper, School Board News. More significantly, NSBA's board of directors in 1984 declared they would launch a "technology initiative" within the organization to help state school boards associations and local school boards make wise decisions about technology. That initiative, in spring, 1985, became the Institute for the Transfer of Technology to Education (ITTE) which I direct.

In some former speeches, after discussing the Star Wars in the Classroom expression as a theme, I tap a button on the hand-held remote controller in my hand; and on the color monitor next to me there appears the familiar gold lettering against a black star-studded background that says "Star Wars," the title from the motion picture of the same name.

This society has created tools so that teachers and students may see almost anything at the time they choose and for their own purposes. Star Wars makes it possible for a teacher or student to see robots, a planet in a solar system with two suns, spaceships, warring political systems, evil black-masked men, religious mysticism ("May the force be with you") and rocks from the Sahara desert, which in the film's story, are supposed to be

on another planet.

The gadget I use to make my demonstration is a larger videodisc of the Star Wars film on a Pioneer 4000 laserdisc player connected to the color monitor. But the specific tool is of less significance than the capacity it represents, a capacity which all the new electronic tools have in common: to make multi-media audiovisual learning as easy as book learning.

Star Wars on laserdisc, in the hands of creative educators, could serve not merely to supplement a book or lecture within a prescribed course of study. Star Wars could be the book equivalent, the center of the curriculum, the raw material around which learning experiences are crafted. But, to truly take advantage, presumptions about hours, tests, courses, and lectures need to be rethought, because audiovisually-based learning (especially using laserdiscs) is fundamentally different from book learning. It is impressionistic, not didactic; it is multi-media, not textual.

Computer-based learning also can, of course, be sandwiched into a conventional school to supplement the daily pattern. But computers, like video, have the power to displace books; to displace paper-and-pencil tests; to displace teacher lectures; and to engage students in patterns of learning that exploit touch and sound as well as text. Used to its fullest, computer-based learning must challenge conventional presumptions about hours, tests, courses, and lectures. Moreover, it should be noted, computer-like experiences and video-like experiences are merging into a new hybrid category of learning experience sometimes called "video computing" or "interactive video." Other important technology includes multi-media machines such as AMIGA and the Apple IIGS coming from computer manufacturers, audio/video controllers coming from the stereo industry, and Digital TV coming from the

TV industry.

The Star Wars phenomenon in education is this: in the guise of floppy discs, videotapes, videocassettes and other gadgets and equipment, America has a new communications industry, which we might call "the learning industry," that produces packaged learning experiences.

Star Wars is a $60 package. The WICAT System is a $100,000 package; Writing to Read is a $20,000 package; Bank Street Writer is a $100 package. At all price levels, the shrink-wrapped learning package, the frozen learning dinner, as it were, is the coming learning reality. Videotape, videodisc, motion picture, computer program, interactive video, CD-ROM, CD-I, laser-cards, bubble memory, all these and more are the new packaging technologies. Books were only the first learning packages. They were so powerful that we shaped education institutions around them. Now there will be many other media, each with their own characteristics, which collectively spell a new era (the "Information Age," if one favors that description) for education institutions.

The conventional school avoids the revolutionary impact of this development by minimizing the use of learning packages, by insisting that they be supplementary, by insisting that students' time be devoted to books and to teachers. The conventional school also assumes that learning packages outside the school are not the school's concern. The home VCR, for example, is not on the educator's map. Like books before them, however, learning packages function anywhere. They are not classroom bound. They work in a living room, church basement, shopping center, factory, or at the beach. Like books, learning packages can be published and sold. Unlike books, they also can often be transmitted from place to place instantaneously. It was once true

that the school encompassed the entire learning package, but now every home may become a school.

As a comparison, it may be instructive to look at the evolution of the American way of nourishment, which perfected the flash-frozen dinner before the learning industry perfected the flash-frozen lesson. A century ago food production was local. So was teaching. The variety of available food to any household was surely limited compared to today; most food preparation was done within homes and families. Similarly, the variety of learning opportunities was limited; most learning opportunities were handcrafted by teachers working in classrooms. Today we still idealize a course-by-course ladder of lectures and tests to graduation.

Yet today, where once adults would of necessity have said, "Eat the turkey or go hungry; that's what's for dinner," many adults now can say, "There's lasagna, turkey, and meatloaf in the freezer; fix yourself something in the microwave." Similarly, where once teachers would of necessity have said, "Study the algebra and read chapter 19 in social studies, that's the curriculum," many teachers can say, "There's a resource center full of learning options; let me suggest some you might try." Food comes in great variety today because much of the preparation is handled elsewhere than in homes. So it is likely that learning will come in great variety as the preparation of lessons is handled elsewhere than in teachers' lesson plan books.

The evolution of the American way of nourishment occurred as an industry developed that exploited technologies at every level of operation. Not only are there electronic devices such as microwave ovens and freezers in homes and restaurants, but air conditioning helps prevent spoilage in food stores, overnight air delivery increases the use of perishable items, flash freezing

preserves meats and prepared foods, and industrial ovens and automated packaging equipment sustain food preparation plants. The nourishment system works because complementary systems of technology are exploited in homes, in Safeway stores and in Sara Lee kitchens, not to mention in McDonalds, Burger King, Denny's, and Big Boy.

The educational system today and tomorrow is evolving in the same direction. In size and sophistication, school book publishers are modest organizations; the "learning industry" also includes CBS, MGM, IBM, and many more enterprises large and small. It has grown and is growing, serving learners in schools and in homes, in government and in industry, by taking advantage of new technology for teaching and learning. Look around: the videotape business grows; electronic databases and electronic mail are increasing; computer software companies continue to emerge and to merge into larger firms; training companies design custom learning materials and are fast becoming publishers as well; television and film companies are creating school subsidiaries; state government is supporting design of software for schools and for adults; the public TV community is rethinking its mission, determined to deliver services through several electronic devices. At least one private corporation and one state government consortium of 19 states are planning to create nationwide electronic networks or "information utilities" to deliver packaged instructional tools to schools and to homes nationwide. Packaged lessons are helping education expand within and beyond schools. Time for Results notes that America is a land of choices and this should be facilitated by an array of learning packages.

One should not be a Pollyanna about a new technology-based learning industry. Just like the food industry, it will have its faults and its

shortcomings. There will be some chaffing between traditional and new approaches, some turf battles and some faddism. There will, no doubt, be educational equivalents to junk food and empty calories. This new industry, like the food industry, invites careful and enlightened scrutiny and regulation. Nevertheless, the development of a new electronic learning industry is timely.

This is the first decade of that learning industry's growth. It may take three decades for it to become an international giant. Left entirely to its own devices in the marketplace, the learning industry is likely to gravitate to the easiest markets first, such as military training, and to perceive itself as competing with existing institutions, such as public schools and colleges. Signs of these trends are visible.

Yet America's best interest lies in harmony and mutual support between old and new educational delivery, and in sharing the benefits of the electronic educational methodology throughout the society. I believe government's historic commitment to improving education for all Americans dictates that government should both nurture and shape this industry. Local, state, and federal government, through grants, joint ventures, research and evaluation should welcome and support this new industry. By harnessing the nation's newest technologies, the learning industry gives promise that better education for all Americans will occur. Politically, and educationally, the growth of a learning industry is the key to Star Wars in the Classroom, the key to a more productive educational system.

ISSUES IN TEACHING WITH TECHNOLOGY: A PROFESSOR'S PERSPECTIVE

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Teaching and technology are of fundamental concern only as they advance the educational interest of students. Furthermore, emphasizing learning stresses the active nature of the process. This paper concerns major improvements in learning systems that are possible with technology.

Learning, I claim, is in trouble at all levels and in most parts of the country. Our current educational institutions do not do an adequate job. But we have now access to new technology for learning that makes it possible to improve our systems, provided we use that technology in reasonable ways. There are a few, but important, points that seem critical for the best use of the new technologies in education.

1. INTERACTIVE LEARNING TECHNOLOGY HAS TREMENDOUS POTENTIAL FOR AIDING LEARNING.

We have been engaged for about twenty years in the use of the computer as a learning mode. This work has taken place in many different countries and in many laboratories. Much of the effort of this period can be characterized as experimental, and mostly on a small scale. Many ways of using the computer were explored. Although I would not regard progress as always in the right direction, we have begun to learn about useful ways to use computers in aiding learning. Both the equipment, and our ability to use it, have changed rapidly during this period. Interesting products have been developed and used in schools and universities. We now have enough experience with the new technology to forecast likely future successful development.

The key learning factors are individualization and interaction. We can once more make learning an active experience. There is general agreement that it is better to make students participants in the learning process when dealing with a new technology rather than only passive spectators. And we can, to a far greater extent than at present, treat such person as a unique individual. Although we say that all students are different, our current modes of education are poorly equipped to react to individual student differences.

These two factors, individualization and interaction, can lead to a revolution in learning. But hardware alone does not accomplish this. We can only realize the benefits of the computer with excellent curriculum material that uses the new technology.

We still have much to learn, however, about the details of use of this new approach to learning. Current experimental studies are often weak, using outmoded materials or too few students.

2. SO FAR THE NEW TECHNOLOGY IS OFTEN USED POORLY, BOTH IN SCHOOLS AND IN UNIVERSITIES.

We are still in an early stage in the use of computers in education, with much to learn. We have produced many small programs, but much of what is happening now in schools is not desirable. The teaching of programming, for example, is often a disaster, judged by its effect on students. Further, many of the programs used in schools are poor pedagogically, and the support material to make computer tools useful for all students is often weak or nonexistent. Some programs work well for a few well prepared and motivated students and teachers, but are inappropriate in their current form for most students and teachers.

In spite of the widespread use of computers and related technologies

at all levels of education, a strong case could be made that today we are doing more harm to students than good. Both teacher and student time is wasted with poor material.

3. OUR EDUCATIONAL SYSTEM AND OTHERS ELSEWHERE IN THE WORLD HAVE GREAT PROBLEMS, PERHAPS UNSOLVABLE WITHOUT COMPUTERS.

Over the recent decades, we have had many studies of the educational systems of the United States, documenting a long list of major problems in education. To my mind, the central problem is that many students do not learn. In a typical class, only one third of the students, at best, fully master the material. The fundamental difficulty is allowing the majority of teachers the opportunity to provide individual attention in typical classes. In most classes, a fixed pace is required and particular learning problems cannot receive much attention. The dominant issue in schools is class size; individualization is unlikely in a twenty-five student classroom. Many students do not learn at the mastery level. Students with unusual backgrounds, or special interests, are treated poorly.

Another major problem faced by American schools is the condition of teaching as a profession. In terms of salary and status, teaching is not a desirable career, as viewed by many students entering college. Recent figures from the National Education Association put the average teacher salary in this country at $25,000. In addition, teacher training institutes are in disarray with a smaller ratio of the best students in attendance, and declining numbers of students overall. In mathematics, for example, we train only one-fifth of the teachers that we trained in 1971, according to data from the National Science Teachers Association. I have seen estimates of how many teachers are qualified; these vary from 50 to 70 percent. Many rural schools do not have teachers at all for advanced subjects, such as

physics and trigonometry.

The teacher situation is made even more difficult because of the retirement rates expected in the next few years. It is estimated that about half of all teachers will retire in the next ten years. As suggested, we have little hope of replacing these teachers. So we can expect fewer and fewer qualified teachers.

4. A LARGE-SCALE DEMONSTRATION EXPERIMENT IS NEEDED TO SHOW US WHERE AND HOW TECHNOLOGY IS EFFECTIVE AND TO CONVINCE EVERYONE THAT THE COMPUTER CAN IMPROVE OUR SCHOOL SYSTEM.

Given the exciting potentials of the new technology to improve learning, given our current poor use of the technology, and given the current difficulties of education, we need to ask how we can proceed toward more effective use of interactive technologies to aid learning.

We need a large-scale experiment to demonstrate the strengths and weaknesses of the new technologies that includes carefully developed courses. Most current material is inadequate to needs, so the learning materials to be used in this experiment must first be developed for the experiment to take place. Thus we need two stages for the experiment, a development stage and an evaluation stage. The following suggestions might structure such an experiment:

1. Learning material developed for the experiment should be full courses, or in a few cases, sizable segments of courses. Fragments of material will not be adequate.

2. About twenty courses should be developed.

3. These courses should use whatever media the developers think necessary. Thus computers will not, in some cases, be the only learning material available to the students.

4. These courses should cover a wide range of levels of instruction and subject areas.

5. No single learning theory or philosophical attitude toward learning should dominate. Instead, a wide variety of learning approaches should be encouraged.

6. Some of these courses should be developed with the assumption that few, or no, teachers will be available to aid students.

7. Each course should define the role of the teacher according to the nature of the subject, technology, and educational goals. In some or many cases these roles may depart considerably from current roles.

8. All the teacher-training material should correspond to the course-development process.

9. The courses must be designed for all students, following the suggestions of mastery learning.

10. Excellent teachers should have a major role in the development process.

11. Careful consideration should be given to the full production process for each course, both in terms of quality and costs.

12. After development, the courses should be widely used, in a great variety of typical schools.

13. A careful summative evaluation should be undertaken, based on the use of the materials. Tens or hundreds of thousands of students should be involved, with a mix characteristic of our schools.

14. Part of the summative evaluation should involve students in countries other than the United States, perhaps developing countries.

15. In the evaluation, the courses should be compared, along many dimensions, with the existing courses in these areas.

16. The evaluations should be undertaken by professional evaluators who were not involved in the development process.

17. In addition to the evaluations for each course, a study should consider the overall lessons gathered from this large-scale experiment.

18. The results of this experiment should be widely disseminated, particularly to teachers, administrators, and parents.

19. Future policy, including large-scale deployment of technology in our educational system, should be dependent on these results.

The scale of this experiment should reflect the difficulties involved in the learning process.

5. GIVEN A SUCCESSFUL OUTCOME OF THIS EXPERIMENT, WE SHOULD CREATE A NEW EDUCATIONAL SYSTEM, BASED ON EFFECTIVE USE OF MODERN INTERACTIVE TECHNOLOGIES.

From what we have learned, we can develop an entire new curriculum, based on new structures for schools, making full and effective use of computers and related technology. We must be careful to preserve diversity or even increase it over our present situation because diversity is one of the strengths of American education. This suggests that we need more than one course in each discipline. I propose that we develop three or four courses of each type. Thus we would have, for example, three or four technology-based algebra courses. These courses would be developed by different groups and would offer alternate approaches to the subject area. A few teachers might also be able to pick and choose among these multiple courses, and add other components to create unique courses.

To create these new courses requires a major national effort and demands the participation of many individuals. Major consideration must be given to the process of moving these new courses into the schools. Older curriculum efforts have not always succeeded in this regard. Thus dissemination procedures need to be carefully considered on a national basis.

The problems are no greater than those encountered in putting a man on the moon, or in other large projects, although they are certainly different. The problems we face are important to individuals, to countries, and to the world. Bold new approaches are needed if we wish to build an excellent new educational system.

ISSUES IN TEACHING WITH TECHNOLOGY: A PUBLISHER'S PERSPECTIVE

Richard Robinson
Chairman, President and
Chief Executive Officer
Scholastic, Inc.

Scholastic is a well known firm which publishes magazines, books, and software designed primarily for those people in schools and at home who want to use computers to teach and learn. We have been in this general field since 1980 when our National Advisory Council of Education first told us that computers were entering the schools. Our firm has made a major commitment to this new instructional methodology, investing more than $20 million and the efforts of 100 professionals over the past five years in the development of educational materials that afford teachers the best opportunities to utilize computers and the latest technology.

Our progress has been dramatic within this short span of years. In 1981, we introduced Scholastic, a magazine for 70,000 school administrators and supervisors which sorts through the field, offers the most up-to-date information, provides perspectives, points out problems, presents solutions, and describes what people are doing. In 1983, we published Teaching & Computers for 50,000 elementary school teachers who want practical things they can do with computers in the classroom. Since 1983, we have published Family Computing, a consumer magazine with 420,000 individual subscribers who want information and guidance about how to use the computer at home. We also publish textbooks which help young people understand how computers work and what they can do. Scholastic now has about sixty technology professionals on the magazine staff.

Scholastic is the largest publisher of school software. Since 1980, we have developed and sold widely such programs as Bank Street Writer, school edition, PFS File, Write and Report, Microzine for middle schools, and a host of other smaller programs such as Success with Reading, Math Shop, Success with Typing, and Operation Frog as well as databases for schools. Our general approach is to publish only those materials which use the computer for what it can do best. We publish tools or utilities such as filers or word processors through which students can use the power of the computer to process words, facts, and numbers, giving them greater control over language and information. Scholastic numbers about 1,000,000 teachers among its customers for all our products; teachers who largely choose our products themselves rather than having their material chosen for them. This close connection with teachers suggests that all learning improvements really must stem from helping the teacher, making her more effective and more in control of the educational environment rather than viewing teachers as only a cost factor to be bypassed, reduced, or turned into facilitators between students and technology.

The student will learn best when a teacher actively teaches, thereby helping to create a personal bond between the individual and what he is learning. From the publisher's perspective, there are several themes which connect this concept to the work of an effective teacher. Scholastic is committed to computer education because the computer can be a revolutionary teaching and learning tool, and can have a profound effect on how students acquire and process information and gain understanding. It is worth reminding ourselves at the outset, however, that the computer's essential role is in stimulating students to think and see things in newer ways, and that one particle of the complex human brain has more "switching systems" than all the

phone systems now operating in the world.

The teacher is the key to classroom instruction and should be. Thus, the most important step for the publisher is to help large numbers of teachers to become proficient in the use of the computer in the classroom. At present, according to Henry Becker of Johns Hopkins University, about 50 percent of computer use by students takes place in so-called "laboratory" settings in which students are seldom under the direction of classroom teachers who understand fully what students are trying to learn. Unless the classroom teacher can integrate the computer into what she is trying to teach, the computer will be an interesting but specific skill like "going to the library." Some years ago I recommended to Secretary of Education, Terrel Bell that we promote computer education on the model of the NDEA summer institutes. This was thought then to be too expensive, but I still believe we should provide $500 million to educate 100,000 teachers each summer in how to be proficient in the use of the computer who would then help others in their schools. Some argued that, with comprehensive administrative programs, this money spent on teachers might be wasted, but it is also true that without teachers feeling comfortable with the computer, nothing will really happen. Actually, the teacher education program used in California called "Technology in Curriculum" constitutes the best state program I know.

Teachers work efficiently when they have internalized their skills. At different levels of functioning, one would not expect the best work from a surgeon or mechanic only because they were given all new tools. Teachers are professionals who will not entrust their most important job, the teaching of basic skills and understandings, to a technology they do not fully control or feel comfortable with. When teachers feel comfortable with computers in the

classroom, they will use the new learning technology with enthusiasm.

In the same context, we have to view the introduction of computers as an evolutionary process that a generation will have to undergo. Right now I would estimate that there are only 20,000 teachers, mainly computer coordinators, who have mastered the computer. This is only about one percent of the nation's two million teachers. Perhaps another 100,000 or five percent, are comfortable with the new technology and almost 500,000 probably have used the computer to a small degree. When five percent become expert, and 25 percent comfortable, these teachers will begin to move others to use the computer in the classroom, not just through passive and limited laboratory instruction designed as a specialist activity.

The nation spends only about $100 million annually or $2 per student on software. This compares to $1.4 billion or $30 per student on other educational materials, including testing. Though we have 1.4 million computers in schools, many of them are very early generation without much power or software. Despite our technological tradition, American schools do not have modern computers which are usable for complex diagnosis and prescription.

It may be fortunate that we are at an early stage of development while we try to figure out what the computer can do best, how teachers can integrate it into their teaching, and how we can purchase more powerful machines and better software. Despite my record of demanding the creation of a national program, I have been completely opposed to big expenditures on courseware or hardware until these fundamental issues have been addressed, most of which take time and some muddle to figure out.

For example, it used to puzzle me that there were not more programs in language or math problems that enabled the computer to diagnose whether the

student is weak in certain areas, then prescribe ten exercises, while alerting the teacher that it is doing this for the student. But to do this kind of diagnosis well takes a computer technology with sophisticated memory capacity. Regretably, we simply do not have machines of such power in the schools.

So far the publishers have wisely confined their systematic curriculum software to the support of available textbooks because there is no teacher or hardware system yet to support a basic instructional system that is computer-based. Moreover, successful software has been the fun, experimental game-like software, and the databases and utilities distributed by essentially supplementary publishers such as Scholastic.

Breakthroughs in the development of educational technology will not likely be linear, but will come from people who are not trying to replicate the current system. Successful innovation depends on a reformation of learning strategies that arise from new approaches altogether rather than from putting textbooks on computer in some sequential fashion. Our software developers tend to work around the edges of curriculum.

In addition to asking how the program carries out a basic learning objective we ask:

1. Is this program fun, challenging and creative, and does it teach something important and basic?
2. Does this program use the computer in a unique way to do something that only the computer can do?
3. Is this program easy to use, understand and relate to?
4. Does it help young people manipulate concepts and have greater control over what they are doing?
5. Is this program effective for young people with language learning difficulties?

6. Does it have classroom research behind it?

I am familiar with at least one new program that does all these things and which excited me because it represents a breakthrough out of dependence on existing educational materials. I refer to The Talking Textwriter, developed by Dr. Teri Rosegrant with Navajo Indian children, based on a generous grant from IBM. The program involves a word processor with speech synthesis capabilities for younger learners ages 3-11. What makes this learning package valuable is its ability to say back to the child any combination of vowels and consonants the child typed on the keyboard. This is a vesatile tool, doing something only a computer could do, providing children with a marvelous support system for early language acquisitions. It is clearly of enormous value in ESL, handicapped, and special education situations, while also being of sufficient flexibility to intrigue faster learners.

In a research situation, Rosegrant proved that the use of this program could significantly enhance early language acquisition. The program also illustrates some limits of computer use in the schools in that it is almost too flexible and too open-ended to use easily. But I have no doubt that anyone who sees this in operation will never wonder how the computer can usefully improve instruction.

A major caution when connecting technology and education is to remember that the computer should not be called on to displace teachers. In contrast to the industrial sector, students will not learn by sitting with hours of programmed instruction on the computer without teacher involvement. It is true that the computer's greatest promise is to individualize instruction and provide diagnosis and followup. But a student without a teacher will simply

be a robot learner without context or richness. The teacher is necessary to create the individualization of computer education for the student.

Furthermore, in contrast to the industrial sector, the problems of copying which have bothered publishers will soon go away. Full copyright protection is not practical in that discs are too easily copied. Publishers will either have to charge more for original programs and allow copying, or supply inexpensive backup discs. This also applies to networking when networking develops more fully.

Finally, we should not be overreaching in our expectations for curriculum-based software until teachers are more fully trained in using computers. Instead, I would appreciate computer education not from the standpoint of a total curriculum, but from what works to make young people enjoy, appreciate, and understand the computer. Yet the pressure to create a full curriculum will grow as the major hardware manufacturers strive to show the usefulness of their computers, and schools try to justify the expense. Now Electronic Learning estimates that networked labs will be the next step: Apple's new IIGS comes with Appletalk network interface; Tandy is marketing its Tandy 1000 as a machine for networks; IBM would like to link PCjr's to distant IBM micros. Meanwhile, "Integrated Learning Systems" are the talk of the day.

Ultimately, of course, I am a strong believer in curriculum-based software and completely support its long-term use. Nonetheless, evolution will be slow until teachers feel comfortable with their computers to teach basic skills. Software will likely become more research-based like The Talking Textwriter. And it will focus more sharply on the curriculum with teacher-and-student friendly software, not programmed learning that is represented by students with earphones who resemble zombies doing yes/no programmed

instruction.

To speed education computer progress, several concepts might be useful:

1. Promote teacher training to familiarize teachers with computer use.
2. Pinpoint areas where teachers can readily use computers and develop good software in these areas.
3. Allow a certain amount of experimentation.
4. Use computers for areas of ESL, handicapped, and special education, especially important for urban schools.
5. Look for broad-based utilities that help students become more powerful learners.
6. Anticipate and promote more research-based software.
7. Acknowledge that vocational training in high schools needs complete overhaul and expanded use of computers, especially in urban schools which need faster breakthroughs for high school students.

The computer is a powerful learning tool that is still in its infancy. But these years of early development are critical to the character and success of computers and instruction. Although haste is inadvisable, we need urgent consideration of educational programs that are innovative and do not arise from existing programs. Successful education in the future will depend on our ability to match the new electronic technology with the educational prescriptions of the modern school.

EDUCATIONAL TECHNOLOGY IN CALIFORNIA

Bill Honig
California Superintendent
of Public Instruction

We have set up a fairly extensive program of educational technology in California. Some years ago the legislature established an independent Educational Technology Commission as part of its earliest package of reform statutes. The Commission was funded in 1983 at a significant level of $25 million a year and is now completing the latest phase of its first cycle of activity. The initial goals of the Commission involved a survey of available hardware and a program to develop academic projects to place the hardware in the state's classrooms. This was fostered by the strategy of giving grants averaging about $10,000 to those schools which worked out effective programs; nearly 45 to 50 percent of eligible districts have come up with acceptable projects. The Commission has also approved a plan to give each California school a VCR, and consideration is now being given to cost-free placement of videodisc players in schools that can utilize these devices in their pedagogy. Within a short period of time, California has disseminated hardware extensively throughout the state's school districts.

The Educational Technology Commission has given special attention to the training of classroom teachers in technology, particularly by use of summer workshops. Much of this has become standard fare in such states as Minnesota and New York. What our record demonstrates is that the best use of educational technology is achieved by preceding its initial applications during the school year with advanced training and preparation.

We also faced the still unresolved problem that development of appropriate educational software takes much longer than the distribution of the technology and training of teachers. To address this difficulty, we have taken steps to establish collaborative efforts and even "partnerships" with the most innovative hardware and software companies in the hope of creating truly outstanding instructional programs.

The history of software development has followed predictable lines of transformation. The first software samples were designed to expand routine exercises in pedagogic drills and practice through the use of computers. They were linear outgrowths of preexisting material and educational strategies. They remind me of the evolution of motor cars whose original bodies looked very much like the horse drawn carriages they replaced; not until later, after the first generation of motor cars were on the road, did automobiles cease to resemble their predecessors. We have had a similar experience with the original products of educational technology.

Unfortunately, the current state of software development depends more on marketing and packaging than innovative concepts. This is not to say these packages are uninteresting or without sound educational values. What they lack is comprehensiveness. In no instance do most available instructional software represent the kind of breakthroughs around which one can build a complete curriculum.

If there are too many gaps in the range of academic software now produced, this suggests a methodology for the third stage in developing educational technology. As an example, let us use a fifth grade mathematics class. Why not begin by asking the best math teachers in California what they need to enhance instruction for 180 days of required classes? What are

students taught throughout the academic year? Can this pedagogical time-sequence be put down on paper and outlined as course requirements? I believe such an examination would indicate prevailing strands of success within the curriculum: experiments with computational mathematics; numbers and oral exercises; mathematical games; individual tutoring; reinforcement with task cards; even the use of movies and a host of other unpredictable ways teachers help their students learn. We know great teachers know how to create innovative instruction. The basic idea is to understand what makes effective practitioners and to find ways to incorporate outstanding curricular features and methods most amenable to software development.

We recognize the importance of the publishing industry in California. About six months ago, we had all the major software firms in the nation attend a conference and put before them our specifications for future applications of their products. We even proposed a financial consortium, using public funds, to guarantee that publishers put together materials in mathematics, science, history, and literature that will move this industry beyond imitation to innovation. We are uncertain about how long this process will take and how much it will cost, but we are certain this is the path to successful development.

We realize development should not be a singular California effort. Ultimately, this process must be a national undertaking; there should be up to a billion dollars invested in such a program by the federal government over a five-to-ten year period. If we are serious about demanding higher standards at every level of education and for the broadest range of students, the collaboration of the states, federal government, and publishing industry are necessary.

Just consider the costs involved in developing new curricular materials in the sciences that are going to be used with a new technology. Such a transition means teachers have to be prepared in advance of the school year; they have to gain an understanding of the entire subject as well as a command of the machines to be used in the classroom. The exciting thing is to remember that while a given teacher cannot be an expert in every scientific field with a mastery of each detailed subject, the integration of outstanding software in the curriculum can expand the capacity of our teaching workforce. When I was in contact with the National Geographic, I discovered this organization had huge vaults containing an immense treasury of photographs. Although this material is in the possession of the National Geographic, someone has to organize it in a systematic way, and it has to be assembled for use with the new technology within the context of an entire curriculum. Thus, if a sixth, seventh, or eighth grade teacher has a particular assignment, lessons incorporating the treasures of the National Geographic can be displayed with clarity and in conformity with the needs of an overall academic plan. One can imagine what such an undertaking would mean in adding quality and power to the academic program. Educational technology, properly applied, can help us win the toughest battle of all in getting students interested in subjects taught in schools.

There are dangers in the use of educational technology. Most of the current software and computers reinforce the bureaucratic tendency in education to narrow each task to the point of making it dull and unteachable. But the great promise of technology is its ability to make students more active in the learning process. This is similar to what we know about good readers. They are people who are able to hold lots of information in their

heads; they do not skip and skim. They are not superficial in mastering their assignments. Good readers are always asking themselves questions about what they are reading; they are active learners, interacting with what they read. Bad readers are different. They are much more passive, approaching books like they watch television. Bad readers skip and skim; they are not involved with their texts. We need educational technology that invites students to be active and comprehensive readers.

Software can be developed out of what we know works best in classrooms. These materials can have programmed pre-reading exercises, questions that test comprehension, and qualitative goals that set higher expectations of performance for all students. Software should establish a learning program that is interactive for students. The gift of technology is its capacity to create a learning situation that replicates the best experience we have had with educational excellence.

In short, our aim in California is to secure a breakthrough in educational technology by matching the best teachers, engineers, and publishers. We have generated a tremendous amount of activity along these lines. My hope is that we will develop comprehensive packages rather than disparate materials growing out of a dependence on too many inadequate textbooks. Our combined leadership in educational technology, whether as teachers, school administrators, professors, or public officials, will help to advance the professionalism of education itself.

CONCLUDING STATEMENT

Fred Hechinger
President
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Educators are uncertain about the role technology will play in the future. Their views about computers, for instance, range from enthusiasm to condescension. Some predicted during the course of these proceedings that computers will ultimately replace books and significantly reduce the number of teachers. Other participants rejected such ideas as either wrong or dangerous to education. This conference on "New Frontiers in Educational Technology" simply proves that the debate over using computers in the classroom is as vigorous as it is important.

The first presentation by James E. Dezell, Vice President of IBM Educational Systems, described an application of computer technology that has received wide acceptance. Mr. Dezell's model was IBM's Writing to Read program, created by John Henry Martin, a retired teacher and school administrator. I recalled something Mr. Martin told me at the very beginning of his experiment, which was later developed by IBM. Mr. Martin remembered that when he entered school he was taught initially by writing on a slate; reading followed quite naturally. He saw the computer as the modern equivalent of a slate. Today thousands of youngsters, including many in inner-city schools, are learning to read by first writing on a computer.

But even some who admire that program pointed out that the computer is no more than a tool, a means of leading students to competency in writing. It may very well be that writing can still be taught in many ways, including

the successful use of pencil and paper. We know that in growing numbers of schools, children in kindergarten and first grade are encouraged to write without any formal reading instruction whatever. The innovative program at Teachers College, Columbia University, developed by Professor Lucy Calkins, relies on children's desire to write about what interests them, on the teacher's love of writing, and on a process that stresses "editorial conferences" and rewriting rather than the instructor's disapproving red pencil. In either case, whether Martin or Calkins, the principle is to begin education as an extension of the student's experience and get started immediately with writing and reading. This works with or without technology. If the computer can help, so much the better.

Another use of technology which delighted everyone was the display given by representatives from The Video Encyclopedia of the 20th Century. This is an historical resource containing 75 hours of film on cassettes or laser discs reproducing film material recording the great events and personalities of this century. Though the film material has no voice-over commentary, the Encyclopedia's extensive background text in book form places each documentary segment in historical perspective. Do you want to see the original Scopes trial? It is there. Take part in the inaugurations of all of this century's United States presidents? Each is available for comparison. You can also hear Dr. Martin Luther King, Jr.'s moving premonition of death, the day before his assassination. War and peace, statesmen and fools, fads and foibles--they are all available for instant transfer to the classroom.

Despite the educational value of The Video Encyclopedia of the 20th Century, these original materials do not greatly disturb the basic operation

of instruction. This historical resource gives students insights that are not otherwise available. It permits the teacher to decide on what to use, how to use it, and its format clearly enhances the nature of what students can learn. Here again we have an example of new ways of teaching with a compatible match-up of technology and instruction.

Both Writing to Read and The Video Encyclopedia of the 20th Century prompted consideration of the relationship between technology and verbal learning. Are we going to do without books in the future? Will computers and video create a non-verbal school environment? I believe these questions are crucial. Obviously, as a journalist, I would not be long in business if the new technology abolishes the use of words and books; it is equally apparent that American culture, typified by television, has already moved considerably in that direction. I do know the newspaper business has been hard hit by the growing dependence of our population on television news-casting. The closing of many newspapers and unemployment of too many journalists represent a decline of the traditional verbal culture. If we go further in this direction, however, all the important goals of this conference will go down the drain. Can Writing to Read be effective if one no longer relied on the image of the letter? Will voice-computers replace the teacher in the use of history recorded by The Video Encyclopedia of the 20th Century? There will be little incentive for students to learn if we assume that technology can supplant the need to read and write effectively.

We agree that technology will not really displace the teacher in education. An initial item here is the question of equity and recruitment of minority teachers. If there is less employment for people in education, there will be little equity in the future. This subject prompted more

general discussion of the educational workforce. Technology can make teachers better. Our first need, however, is better candidates for the profession. It makes little difference if instruction is revolutionized by computers when some of the people we depend on to guide this transition are either incompetent or indifferent. In addition, every concerned educational leader at this conference remembered earlier failures of educational technology: the once oversold teaching machines with their simplistic programs; the unfulfilled promises of instructional radio and television; and the lessons beamed in the 1950's from circling aircraft into the schools of many states, regardless of whether or when teachers wanted them for their classes. Costly equipment, several superintendents pointed out, often gathers dust in school basements. Educational reform cannot succeed with directions and goals that disregard the interests of teachers.

Nor can we disregard the quality of instructional programs, even when they utilize the latest technology. This point was made repeatedly during virtually every discussion of conference papers. Perhaps the most focused criticism of the quality of computer software came from William Honig, the elected Superintendent of Public Instruction in California. Mr. Honig has already demonstrated his demand for quality by rejecting every textbook on mathematics presented by publishers for use in the California schools. Will these publishers, already under fire for producing low-quality textbooks, simply shift to producing inadequate computer software for our classrooms? Alfred Bork, director of the Educational Technology Center at the University of California at Irvine, also denounced the utilization of "bare technology." "We must build a curriculum, first," he asserted in responding to questions. This calls for the development of entirely new instructional software,

sponsored by the federal government, and refined through a national process of experimentation. There is little sense in making current education more costly by installing inadequate computer software that will also make instructional progress much worse.

This does not mean all computer programs are inadequate. Mr. Honig described the effort in California to develop quality software, suggesting that if it does, we may no longer rely on textbooks as the foundation of classroom instruction. That, it should be underscored, does not mean there will be no books. What it does mean is that the evolution of outstanding software requires substantial investments, probably on a national scale, with the replication of those programs that work. Though there is reluctance to look at what works elsewhere, it is essential for responsible educational administrators to duplicate the best experience of other school districts. Otherwise, given the costs and complexity of instructional software development, we may never move beyond the most routine applications of educational technology.

Another point stressed by Mr. Honig and David Florio of the American Federation of Teachers is the importance of a new kind of training for future teachers. Not only must teacher training guarantee familiarity with the potential and application of different educational technologies, we must also get away from running schools on an industrial model; for example, in New York City sixty thousand teachers must punch a time clock twice a day, much as industrial workers do in American factories. This has to be changed. Mr. Florio warns that there can be no uniform grand design for such an undertaking; diverse conditions, whether inner-city schools, suburban districts, or rural areas all call for different educational structures.

I agree that we must open up the schools and move them away from industrial models. We should also deregulate the school day and afford each student instruction properly corresponding to educational needs, and spell out broad goals and expectations for deregulated schools so they may exceed the former standards for students based on so-called "minimum competencies." The reform agenda will not be fulfilled unless better qualified teachers perform in an educational environment that no longer constricts their creativity.

Still there remain the fundamental questions relating to "New Frontiers in Educational Technology." Can technology reform the way knowledge is transmitted? Will the educational outcome be greater depth or merely glossier packaging? Will educators determine content? Will schools of the future accommodate or limit instructional quality? As we answer these questions, we must insure that the inevitable process of educational change is a progress toward excellence.